



## Performance and Poverty Convergence in North Sumatra

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### Article Information    Abstract

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North Sumatra is one of the growth centers in Indonesia. However, its number of poverty is one of the highest nationally. This study aimed to see the performance and prove whether there is a convergence of poverty in North Sumatra Province during the years 2011-2021. The analytical method used included quantitative descriptive analysis. Through the Klassen quadrant which was divided into two periods, it can be seen that some regions have moved quadrants and some other regions have moved towards quadrant lines at different levels. The situation showed serious inequality in some areas that were in quadrant 4. The results of the Williamson index showed that the degree of inequality in poverty levels between regions tended to decrease, although there has been an increase in several years of observation. Through the sigma convergence test, it was strongly indicated that there was a dispersion of poverty levels between regions towards one common ground. It has been further confirmed by the absolute beta convergence test. Real income per capita and RLS that included in the conditional convergence model have proven to accelerate the process of poverty convergence between regions in North Sumatra.

## INTRODUCTION

Ending poverty is one of the seventeen goals in Sustainable Development Goals or SDGs. In line with an idea stated in the Outcome Document Transforming Our World: The 2030 Agenda for Sustainable Development, the very first goal of SDGs is to end poverty in all its forms everywhere. This goal must be the theme for development, the main agenda, and sustainability that underlies various other development goals, such as infrastructure, tourism, food, energy, and others (Bappenas, 2022). The expected economic growth continuity for poverty alleviation seems to face some constraints. It was found that different intensity and speed of development among regencies somehow increase poverty disparities and possibly open up dispersion opportunities.

In this study, the concept of diminishing returns on capital and workforce by neo-classical economists was adopted into a poverty format. It was inspired by Solow's growth model (1956) which predicts that poor countries will grow faster than rich countries. With the same technological access, countries who have low income with low capital are possible to have higher marginal products, and this greater capital accumulation, those poor countries can grow quickly. Unfortunately, some previous studies have different conclusions. R. J. Barro, (1991), Pritchett (1997), Rodrik (2013), and recent literature, Johnson & Papageorgiou (2020) found that over a long period of time, on average, poor countries do not grow faster than rich countries indicated by the results of comparison between the initial and the following condition of Gross Domestic Product (GDP) per capita which showed no significant changes. On the other hand, Patel, et al. (2021) rebut it in his study that since the mid-1990s poor countries have been able to grow faster than poor countries, but not as fast as middle-income countries.

Adams (2003) found that growth is a significant medium to alleviate poverty in developing countries. Economic growth reduces poverty because any growth contributes to small impact on income inequality. When economic

growth is measured using average consumption, there will find a strong relationship between growth and poverty alleviation. A similar thing happens when the growth is measured using GDP per capita, although it is not significantly strong. Crespo Cuaresma, et al. (2022) have proved that by combining poverty reduction growth elasticity derived from Bourguignon (2004) and proportional poverty convergence framework from Ravallion (2012) the poverty reduction proportion for a particular economic growth is smaller in some poor countries. That is why poor countries can progress faster due to the convergence effect of average income, but smaller poverty alleviation than the level of income.

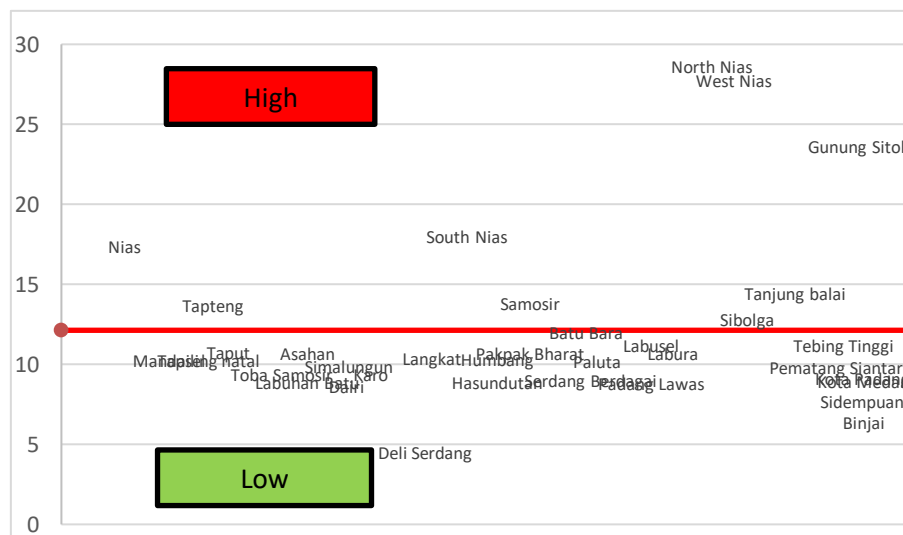
Poverty alleviation is a major indicator in measuring development performance. continuous and progressive economic growth is expected to reduce poverty rate. It is because the rise of growth poles and polarization will influence two states, namely backwash effect and spread effect. The attraction of those two effects on surrounding environment leads to two conditions, namely convergence and divergence.

We were interested in investigating the performance and poverty convergence rate in North Sumatera as a region which contributes the largest Gross Regional Domestic Product (GRDP) in Sumatera Island until 2021, namely 23.37 percent and ranked 5 in the national economy scale. It shows that North Sumatera is a center for economic growth in Indonesia. However, the population in this province is quite large, namely 1,343,860 or ranked 3 after West Java, East Java, and Central Java with the poverty rate of 9.01 percent. All these number and percentage increased compared to 2020, along with other provinces.

There found some cities whose poverty was extreme, including Gunung Sitoli City, North Nias, West Nias, Nias, and South Nias. All these five cities belong to Nias Islands. The following figure 1 divides poverty conditions in two categories, namely high and low. Regions were grouped by calculating the average poverty rate during 2011-2021 in each regency and city. The red dividing line is the average poverty rate

between regions during the year of observation. The average result was obtained from the average sum of each regency and city divided by the total cross section, which was 12.13 percent. Regions that are above this figure are categorized as areas

with high poverty, while areas that are below the average number are classified as areas with low poverty. The details can be seen in the following image:



**Figure 1.** Poverty Clusters among Regencies/ Cities in North Sumatera in 2011-2021

Source: Statistics Indonesia (processed)

There were 10 regencies with high poverty rate, consisting of all regions in Nias Islands, Central Tapanuli, Samosir, Tanjung Balai, Sibolga, and Batu Bara. It can be seen from the distribution of dots which are close to the middle line. Based on a convergence concept, if there is a dispersion leading to a meeting point, all regions will move to dividing line.

Didia (2018) in her study analyzed factors influencing development inequality in Kedunsepur regency to find any convergence in it. She finally found investment and participation rate of workforce have no significant impact on inequality, while Human Development Index (HDI) and number of populations do. Also, it is known that convergence has happened in Kedungsepur region. In addition, Setiawan, et al (2020) analyzed farmer exchange rate, manufacturer sector growth, agricultural sector growth, schooling period length, informal workers percentage on poverty rate, the effect of industrial sector ratio on agriculture, and education ratio on income inequality, and the relationship between the poverty and income inequality rates in Java, Bali, and Lampung.

They used pooled data and correlation analyses. In findings, it is stated that the industrial sector effect is greater than agricultural in reducing poverty, namely -0.47 percent: -0.40 percent. Farmer Exchange Rate (FER) and informal education ratio have no significant effect on poverty, informal education has a positive relationship with poverty, manufacturer sector productivity ratio and agricultural sector have significant contribution in reducing inequality, and elementary education ratio has no significance to inequality.

Zulham, et al. (2019) studied economic growth convergence in east coast of North Sumatera. They concluded that the inequality in that area during 2003-2015 experienced increase and decrease. The independent variable (working people, number of poor people, and schooling length average) greatly influence the speed of economic growth convergence in the east coast of North Sumatera.

The previous study findings regarding east coast of North Sumatera economic convergence motivated the researchers to deeply investigate another aspect, namely the

divergence. According to the findings of Crespo Cuaresma, et al's study (2022) the convergence effect of average income can cause poor regions to experience rapid growth, but smaller poverty reduction. Moreover, the poverty reduction proportion among regions in North Sumatera can lead to a meeting point, or vice versa depending on the speed of poverty reduction offset by a slowdown in developed regions.

This study used some instruments to detect poverty rate. First, convergence analysis model was used to determine the development of poverty dispersions among regencies and cities in North Sumatera province. Conceptually, when economic growth and per capita income get slowdown, other regions will have great chances to catch up. Second, the hypothesis build in this study was if this situation takes place, then ideally it can also reduce the poverty gap between regions in North Sumatra. Third, real per capita income was an instrument acted as a proxy for population productivity and welfare and the average length of schooling (RLS) as a reflection of the education dimension to see the magnitude of its influence on changes in the speed of convergence/divergence and its partial effect on poverty levels. It was strongly suspected that real per capita income and RLS were negatively related to poverty. Thus, the present study attempted to analyze the performance and poverty rate convergence among regencies and cities in North Sumatera within 2011-2021.

## RESEARCH METHODS

This study strived for examining the performance and the convergence or divergence of poverty rate in 33 regencies and cities in North Sumatera within 2011-2021 using the data from Statistics Indonesia of North Sumatera Province, covering poverty rate, number of poor people, GRDP based on constant price (ADHK) and schooling length average. The real per capita income was adjusted based on the number of people from the 2010 and 2020 censuses processed by calculating geometric projections from 2010 to 2021. The population projection results became the divisors of ADHK GRDP

published by Statistics Indonesia. Then, all convergence data were converted into natural logarithm form.

In terms of analytical mode, this study used descriptive and quantitative analyses. To see the performance of poverty and real per capita income, Klassen typology was used. It divides performance between regions into 4 quadrants, where the average value of the poverty level and real income per capita between regions forms the quadrant line. Another measuring tool was the Williamson index to see the degree of inequality in poverty between regions. If the index value is close to 0, then it is more evenly distributed, but if the value is away from 0 then it is more unequal. The Williamson index formulae is as follows:

$$IW = \frac{\sqrt{\sum((Y_i - Y)^2 f_i / n)}}{Y} \dots\dots\dots(1)$$

Where, IW is the Williamson index,  $Y_i$  is the poverty level of area  $i$ ,  $Y$  is the average poverty rate,  $f_i$  is the number of poor people in area  $i$ , and  $n$  is the total number of poor people.

Convergence occurs when the economic condition in poor regions grow faster than that of rich regions, so poor countries tend to catch up with rich countries in terms of the level of income or product per capita. The second concept is related to cross sectional dispersions. Here, convergence will occur when the estimated dispersions, for example by the logarithmic standard deviation of per capita income or production in a group of regions, decreases over time. The first convergence tends to produce a second type of convergence, but this process is offset by new disturbances which tend to increase the dispersion. The model builds on the assumption that the random perturbation of changes in production and the rate of technological progress is the same for all economies (Barro, R. J., 2004).

The analytical instrument to examine any convergence was sigma convergence analysis and beta convergence analysis. The first beta convergence analysis examined absolute terms. It used the following equation:

$$\ln Y_{it} = (1 + \beta) \ln Y_{it-1} \dots\dots\dots(2)$$

Where,  $Y_{it}$  is the level of poverty in a particular year and  $Y_{it-1}$  is the previous year poverty. When the condition is  $-1 < \beta < 0$ , it can be concluded that there is a convergence of economic growth in the regions and periods. Oppositely, an absolute convergence will not happen if the value is  $\beta < -1$  or  $\beta > 0$ . Then the  $\beta$  is close to  $-1$ , the speed of a convergence is high, but then the value of  $\beta$  is near  $0$ , the speed is slow. Moreover, to see the length of time needed to eliminate half of the inequality, the following formula was used:

$$t = \frac{-\ln(0,5)}{\beta} \text{ or } t = \frac{\ln(2)}{\beta} \dots\dots\dots (3)$$

The next analysis was to include panel data regression model on the conditional convergence analysis using the following equation:

$$\ln Pov_{it} = (1 + \beta) \ln Pov_{it-1} - \beta_2 PDRB_{riil\ perkapita_{it}} - \beta_2 RLS_{it} + \mu_{it} \dots\dots\dots (4)$$

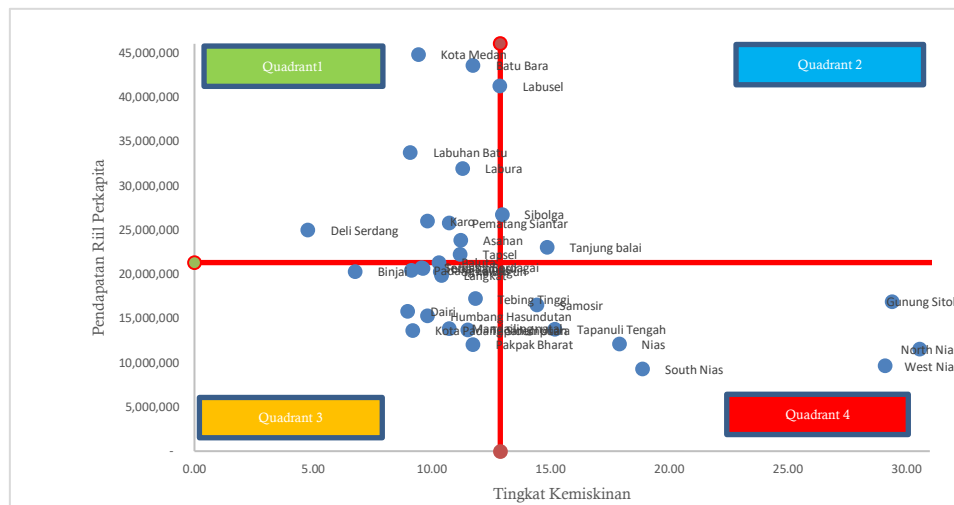
Here,  $Pov_{it}$  means the level of poverty in the current year's regencies and cities, and  $Pov_{it-1}$  is the level of previous year's poverty. The poverty level covers people whose per capita expenditure was below poverty line.  $PDRB_{riil\ perkapita_{it}}$  is the current year's regencies and cities per capita real income obtained from dividing ADHK GRDP of each cross section by the total population. The number of residents each year of observation was calculated based on geometric projections from population census data in 2010 and 2020.  $RLS_{it}$  is the average length of schooling in the city and regencies for the current year, namely the number of years taken by residents aged 25 years and over in undergoing formal education. Finally,  $\mu_{it}$  is disturbance variable (unobserved effect). Then, chow test was performed to determine the best model among common effect and fixed effect. When the fixed effect model was chosen, the next step is performing a hausman test to choose the best model among fixed effect and random effect. When the result is random effect, another step is a LM test to select between common effect and random effect models.

## RESULTS AND DISCUSSION

Poverty was initially observed with mapping Klassen quadrant. This instrument is beneficial to see possibilities of convergence to emerge and the performance of each region grouped into 4 quadrants. Two indicators examined in this quadrant were poverty level and real income of per capita of each regency and city. Here, the researchers divided two periods of time to notice the performance progress of each region towards those two indicators. The first period to observe ranged from 2011-2015.

In 2011-2015 period, 10 regions categorized in quadrant 1 were Medan City, Batu Bara Regency, Labuhanbatu, South Labuhanbatu, North Labuhanbatu, Karo, Pematang Siantar, Deli Serdang, Asahan, and South Tapanuli. This quadrant illustrates the below average poverty along with the above average real income of per capita. Those in this quadrant are said to be developed regions. In addition, quadrant 2 reflects regions which are potential and developing with somewhat high poverty and income levels. Regions belonged to this quadrant were Sibolga City and Tanjung Balai City.

Quadrant 3 covers regions which are depressed with low poverty and real income of per capita levels. There were 14 regencies or cities in this quadrant, including Padangsidempuan City, Binjai, Tebing Tinggi, North Padang Lawas Regency, Padang Lawas, Serdang Bedagai, Simalungun, Langkat, Dairi, Humbang Hasundutan, Toba Samosir, Mandailing Natal, North Tapanuli, and Pakpak Bharat. Following quadrant 3, quadrant 4 includes lagging regions with high poverty level and low real income of per capita. Those who belonged to this quadrant were Gunung Sitoli City, West Nias Regency, North Nias, South Nias, Nias, Samosir, and Central Tapanuli.



**Figure 2.** The Klassen Typology on the Poverty and Real Income Per Capita of Regencies and Cities in North Sumatera Province in 2011-2015

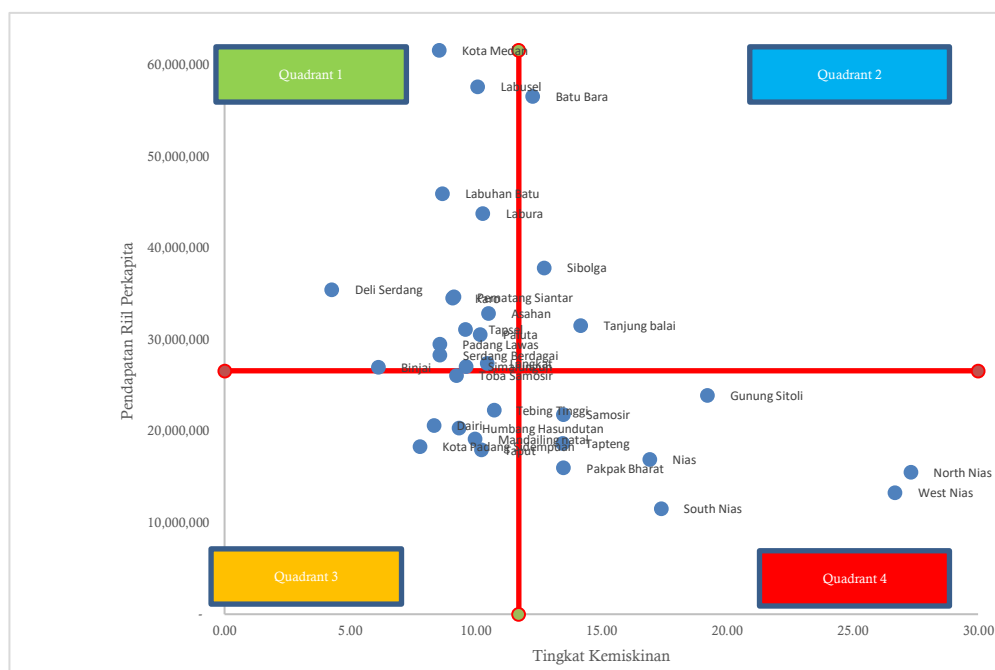
Source: Statistics Indonesia (processed).

According to the division of the second period of quadrant, some regions shifted from one quadrant to another. Batu Bara Regency shifted from quadrant 1 to quadrant 2, while Pakpak Bharat Regency shifted from quadrant 3 to quadrant 4. Sibolga City seemed to move away from the central point of quadrant 2 which was initially had crossover on the vertical line. There also found two regions shifted from quadrant 3 to quadrant 1, namely North Padang Lawas Regency and Padang Lawas Regency. Additionally, Gunung Sitoli City moved to the left from its initial line to quadrant 2 area. In this second observation, there were 11 regions in quadrant 1, covering Medan City, Pematang Siantar, South Labuhanbatu Regency, Labuhanbatu, North Labuhanbatu, Deli Serdang, Karo, Asahan, South Tapanuli, North Padang Lawas, and Padang Lawas Regency. The exclusion of Batu Bara Regency from quadrant 1 along with the inclusion of North Padang Lawas Regency and Padang Lawas made the number of regencies and cities in this quadrant increase to 11 regions.

Quadrant 2 gained three new regions, namely Batu Bara Regency, Sibolga City, and Tanjung Balai. Then, in this period quadrant three had eleven regions, namely Padangsidimpon City, Binjai, Tebing Tinggi,

Serdang Bedagai Regency, Langkat, Simalungun, Toba Samosir, Dairi, Humbang Hasundutan, Mandailing Natal, and North Tapanuli. Conversely, quadrant 4 got a new member, namely Pakpak Bharat Regency and other previously mentioned regions. Overall, the Klassen typology has not yet been able to portray changes of regions to be in a common ground. However, shifts among periods indicated positive development in almost all regions. These results are in line with a study by Rusdi, et al (2019) which concludes that Provinces in Sumatera Island belongs to provinces who are in quadrant 2 or regions which have high growth, but low income during 2012-2016. Another previous study by Sari (2020) divided North Sumatera regions into three zones, namely east coast, west coast, and Lake Toba. It is known that most of regions in Lake Toba are lagging, while those in east coast are relatively more developing than that of west coast of North Sumatera.

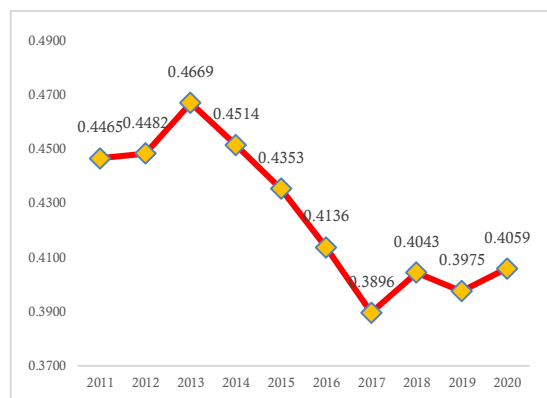
Regarding these findings, the main focus on reducing development performance gap is to pay special attention to all regions in quadrant 4 to shift to quadrant 2 or 3 for then having abilities to proceed to quadrant 1. In details, the second period Klassen typology observation can be seen as follows:



**Figure 3.** The Klassen Typology on the Poverty and Real Income Per Capita of Regencies and Cities in North Sumatera Province in 2016-2020

Source: Statistics Indonesia (processed)

Besides using Klassen typology, the inequality among regencies and cities was determined using Williamson index. This index is good at detecting the existence of convergence. In the following figure, the index line tends to fluctuate, in which within 2011-2013 the line tended to rise, while in the next year until 2017 it experienced a stable downward trend, and from 2018 to 2020 it more fluctuated. The index line tends to rise and fall, but is more dominated by the decrease in index numbers or leads to the reduction of poverty. It became a gateway to explore deeper and re-confirm the convergence that occurred through sigma and beta convergence analysis. A study conducted by (Rusdi et al., 2018) calculated the Williamson index in terms of per capita income. The results show that the disparity of per capita income between regions in North Sumatra is in the low category, although from 2012 to 2016 the numbers tended to increase.

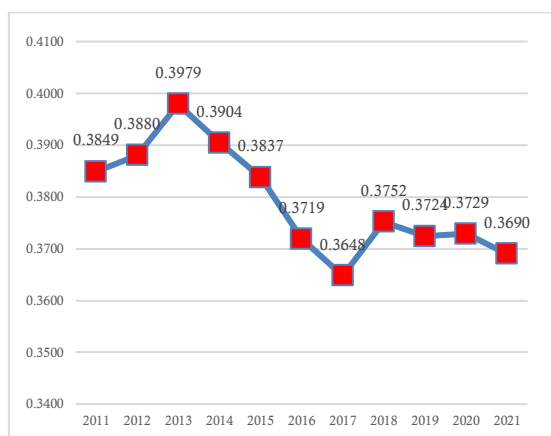


**Figure 4.** The Williamson Poverty Index between Regencies/Cities in North Sumatra Province.

Source: Statistics Indonesia (processed)

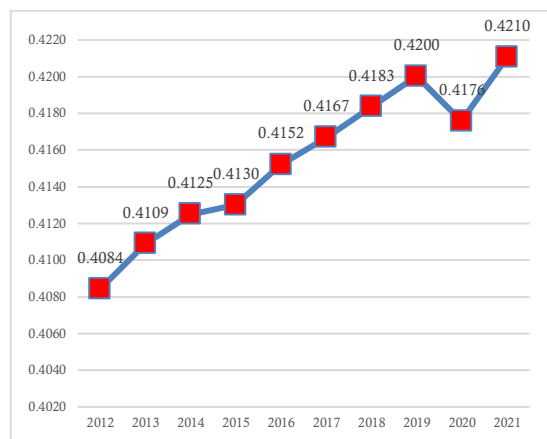
The next step to make sure any convergence or divergence of the poverty development among regions was to see the sigma convergence value. In this test, the observation was focused on the shift of standard deviation of poverty level (natural logarithm data) among regions since 2011 until 2021. The following figure 4 shows the line movement that tends to decrease. In the beginning, the deviation seemed increase from 0.3849 in 2011 to 0.3979 in 2013.

Then the following year the deviation rate fell steadily from 0.3979 to 0.3648 in 2017. However, the deviation rate increased again in 2018 amounted to 0.3752 and again decreased until 2021 by 0.3690. These results provided a strong indication of the dispersion of poverty levels between regions in North Sumatra Province towards a convergence point (convergence).



**Figure 5.** The Standard Deviation of Poverty Levels in North Sumatra Province 2011-2021.  
Source: Statistics Indonesia (processed)

This current study also attempted to review the movement of the of real income of per capita standard deviation, given this variable became a predictor variable discussed in this study. Information regarding the dispersion of real income of per capita surely can strengthen the reliability of conditional beta convergence test. Based on the data analysis, there found a line which tended to rise higher, indicating the direction of real income per capita of North Sumatra was divergence. The real income per capita disparity arouse among the regions emerged doubts about the level of influence of this variable on poverty convergence in North Sumatra. The absolute number of this indicator which continues to increase every year but is not supported by the intensity of its distribution in each region illustrates the existence of a productivity gap between residents of each region. This situation portrayed the ability to reduce poverty in each regency or city.



**Figure 6.** The Standard Deviation of Real Income Per Capita Regency/City of North Sumatra Province in 2012-2021.  
Source: Statistics Indonesia (processed)

Furthermore, absolute beta convergence was performed to ensure whether there was poverty convergence between regencies and cities as illustrated by the coefficient values. Values arising from this test can be utilized to indicate the speed of current convergence after going through panel data regression tests to determine the best model.

**Table 1.** Absolute Beta Chow Test

Effect Test	Statistic	d.f	Prob
Cross-section F	2.064129	(32,39)	0.0009
Cross-section Chi-square	66.414461	32	0.0003

Source: Data Processed, 2022

The above results showed that the probability value of chi-square cross-section was 0.0003 or below 5 percent alpha. In other words, the best model in this test was fixed effect model. After that, this model was compared to random effect model using hausman test.

**Table 2.** Absolute Beta Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	45.864889	1	0.0000

Source: Data Processed, 2022

Hausman test was used to determine the best model among fixed effect and random effect. Since the results showed the probability of a random cross section gained 0.0000 or below 5



percent alpha, this meant that the best model to estimate was the fixed effect model. The estimation results from the fixed effect model can be seen in table 3 below:

**Table 3.** The Estimation Results of Absolute Beta Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.456078	0.0665876	6.849403	0.0000
LN_POV_1	0.804137	0.0272762	29.48113	0.0000

Source: Data Processed, 2022

The estimation results of fixed effect model indicated that the predictor variable, namely lag 1, the poverty level, had a significant effect on the poverty level in the current year with the probability value of 0.0000. Moreover, the above results show the value  $(1+\beta)$  was 0.8041. To determine the condition of convergence, it is necessary to have a value of below zero and above -1. The value of which is between 0 and 1 illustrates the convergence of poverty levels between districts and cities in North Sumatra Province. The value  $(1+\beta)$  was 0.8041, indicating that the value of  $\beta$  was -0.1959. This value of meant that absolute convergence had a convergence speed of 19.59 percent.

Furthermore, to calculate the half life, the researcher used the formula  $t = \frac{LN(2)}{0,1959}$ , and gained the result of 3.5382, meaning that to cover the half of the total inequality there needs about 3.5 years, while the whole needs 7 years. After processing data to answer absolute convergence, the next step was to observe the amount of coefficient value changes produced and any influence from other variables by adding possible variables to influence poverty level. The variables were real GRDP per capita as a proxy for the level of productivity and people welfare and schooling average length (RLS) as a proxy for education dimension. Then, to choose the best model, the initial step was to perform chow test as follows:

**Table 4.** Chow Test of Conditional Beta Convergence

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.048102	(32,327)	0.0010
Cross-section Chi-square	66.311522	32	0.0003

Source: Data Processed, 2022

Regarding the above table, the probability value of F cross-section was below 5 percent alpha. It mean that the best model was fixed effect.

**Table 5.** Hausman Test of Conditional Beta Convergence

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	46.445632	3	0.0000

Source: Data Processed, 2022

Hausman test showed that the random cross-section probability value was 0.0000. Since it was below 5 percent alpha, it meant that fixed effect became the best model. Prior to estimation, the real data were converted into two forms, namely logarithm and natural logarithm. Natural logarithm tends to gain smaller standard error, and this logarithm is the format for deciding the result. Then, the results of fixed effect model estimation to see conditional beta convergence are presented in the following table 6:

**Table 6.** Estimation Results of Conditional Beta Convergence based on Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.964801	0.242930	3.971511	0.0001
LN_POV_1	0.747187	0.036783	20.31352	0.0000
LN_REAL_GDP				
P_PERCAP	-0.001564	0.008930	-0.175141	0.8611
LN_RLS	-0.160780	0.072092	-2.230199	0.0264
R-squared	0.983926			
F-statistic	571.8900	Prob(F-statistic)		0.000000

Source: Data Processed, 2022

Based on the above fixed effect model estimation, there found changes in the coefficient value of poverty level from 0.8041 to 0.7471. In addition, by having  $\beta$  value of 0.2529, the convergence process speed among regions in North Sumatera after including real GRDP per

capita and RLS as predictor variables was 25.29 percent. A conditional convergence model obtained faster convergence speed effect, or the inclusion of RLS and real GRDP per capita boosted the ongoing process of convergence. Another datum is the model obtained F-statistics value smaller than 5 percent alpha which meant that the independent variable simultaneously had a significant effect on the level of poverty. With R-squared of 0.9839, the variation of poverty level was able to be explained by predictor variables by 98.39 percent.

Regarding the analysis, the probability value of RLS was 0.0264 or below 5 percent, indicating that this variable had a significant effect on the level of poverty in North Sumatera Province with low error rate. Moreover, its coefficient was -0.160780, so if the RLS increases by 1 percent, it will reduce the poverty rate in North Sumatra by 0.16 percent. Having RLS affected poverty level strengthens the existing theory that education is dominant at driving development. Education ease of access until university, especially for the poor will expand the influence of this indicator to reduce the existing poverty rate. It is in line with a study by Hadi (2019) that there is a strong and negative relationship between RLS and poverty level. In his study, RLS has its impact on the poverty in East Java province regencies or cities.

Unfortunately, the variable of real GRDP per capita had not significant effect on the poverty level. It was known from the high probability value of 0.8611 or above the tolerance level of t test. This condition was reinforced by the results of sigma convergence on real income per capita which showed divergence condition. It might happen due to the population productivity disparities in North Sumatera. Here, the absence of good connectivity between poor and development activities somehow created a productivity gap between the poor and the rich widened. Further, productivity gap will affect the income gap in society, so there is a need for an in-depth monitoring and evaluation on the programs that have previously been implemented to alleviate poverty in North Sumatera. Also, breakthroughs must be done to involve the poor

people in available development activities. This results are different from that of Elria (20160) who concludes that GRDP per capita has a negative and significant effect on the poverty in West Kalimantan Province. This difference possibly happens because of the different reference of GRDP use of the current prices and constant prices between North Sumatera and West Kalimantan. Lacks of similar studies using the exactly the same indicators to describe this phenomenon caused the findings have limited comparisons.

## CONCLUSION

Based on the mapping of poverty and real income per capita performance through Klassen typology in two periods of observation, it can be concluded that some regions shift to different quadrant, while some others move towards different levels of quadrant lines. Baru Bara Regency shifts from quadrant 1 to quadrant 2 and Pakpak Bharat Regency shifts from quadrant 4 from quadrant 3. Moreover, Sibolga City moves away from the middle point of quadrant 2 which was previously had crossover in a vertical line. However, there are also two regions experienced significant shifts from quadrant 3 to 1, including North Padang Lawas Regency and Padang Lawas Regency. The rest is Gunung Sitoli City which moves towards quadrant 2 area. These findings have proved a serious inequality in some regions in quadrant 4.

In terms of Williamson index, the inequality degree of poverty among regions in North Sumatera Province tends to decrease, although there has been an increase in some years. In 2011-2013, the index line direction increases, however in the next year until 2017 it experienced steady downward trend, and since 2018 until 2022 it fluctuates more often.

Based on the results of sigma convergence test, there obtained a strong suspicion of poverty level dispersion among regions in North Sumatera Province leading to a common ground. It was even reinforced by the results of absolute beta convergence test which concludes that there is a poverty convergence

among regions. Apart from that, the addition of indicators of real income per capita and RLS to the convergence model are proved to boost the process of poverty convergence among the regions. In the partial test, the average length of schooling (RLS) has a significant effect on the poverty level, while real income per capita has no significant effect on the poverty level in North Sumatra.

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